**Environmental impacts of water use in crop-livestock mixed production systems in Northern Ethiopia: Comparative assessment of local breed and crossbred cows**

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**Abstract**

A number of livestock sector development projects have been implemented in recent years in Ethiopia with the aim of improving the dairy-based livelihoods of the smallholder farming communities. The focus of most livestock production improvement projects has been on improving the genetic potential of local cows through crossbreeding. Whereas crossbreeding increases productivity and economic gains, it could have adverse environmental effects due to high resource utilization and related natural resource degradation. This study investigates the economic and ecological footprints of water consumption attributable to smallholder livestock production at Fogera district in Northern Ethiopia. The economic and environmental impacts of water use by crossbred and local breed cows were compared to assess the sustainability of livestock intensification in the district. A Life Cycle Assessment (LCA) methodology and water foot print concepts were used to assess the impacts of dairy production on water resource depletion, ecosystem quality and human health. Milk yield expressed as kg of fat and protein corrected milk (FPCM) per animal was chosen as a proxy for system productivity. Income per kilogram of dry matter feed intake was used to compute the economic contribution of cross breeding. The average daily income per kilogram of dry matter intake was 9.0 and 34.9 Ethiopian Birr (ETB) for local and crossbred cows, respectively. Feed production is the major source of water consumption. The daily water consumption per head per day is higher in crossbred cows. Fresh water use becomes very low when the water use is assessed in terms of kilogram of fat and protein corrected milk. In terms of kilogram of fat and protein corrected milk, keeping crossbred cows has relatively less environmental impact on water depletion. Water consumption by local breed cows result in an impact of 9x10-9 days of disability adjusted life yearson human health (HH) and 2x10-4 m2 per head per year on Ecosystem Quality whereas a crossbreed cow has an impact level of 1x10-7 days of disability adjusted life yearson HH and 3x10-4 m2 year on ecosystem quality. The production of 1 kg of FPCM causes an impact of 2x10-8 days of disability adjusted life yearsonHH and 4x10-5 m2 per year on ecosystem quality by crossbreed cow. The production of 1 kg of FPCM causes environmental impact of 5x10-8 days of disability adjusted life yearson HH and 13x10-4 m2 per year on ecosystem quality by local breed cow. The findings suggest that livestock intensification by keeping crossbred cows could improve the efficiency and sustainability of water use in crop-livestock mixed production systems in Ethiopia.

**Key words:** Life Cycle Assessment, Water footprint, Crossbred cows, Environmental impact